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(54) **BUSHING FOR A MEDIUM VOLTAGE SWITCHGEAR**

(57) The present invention relates to a bushing for a metal clad medium voltage switchgear, the bushing comprising:
- a hollow body; and
- a t-off and pin assembly.

The hollow body is made from polyamide. The t-off and pin assembly is made from polyamide. A first end of the hollow body is configured to connect to a compartment of a medium voltage switchgear. The t-off and pin assembly is configured to connect to a second end of the hollow body. The t-off and pin assembly is configured to connect to a T-off and pin.

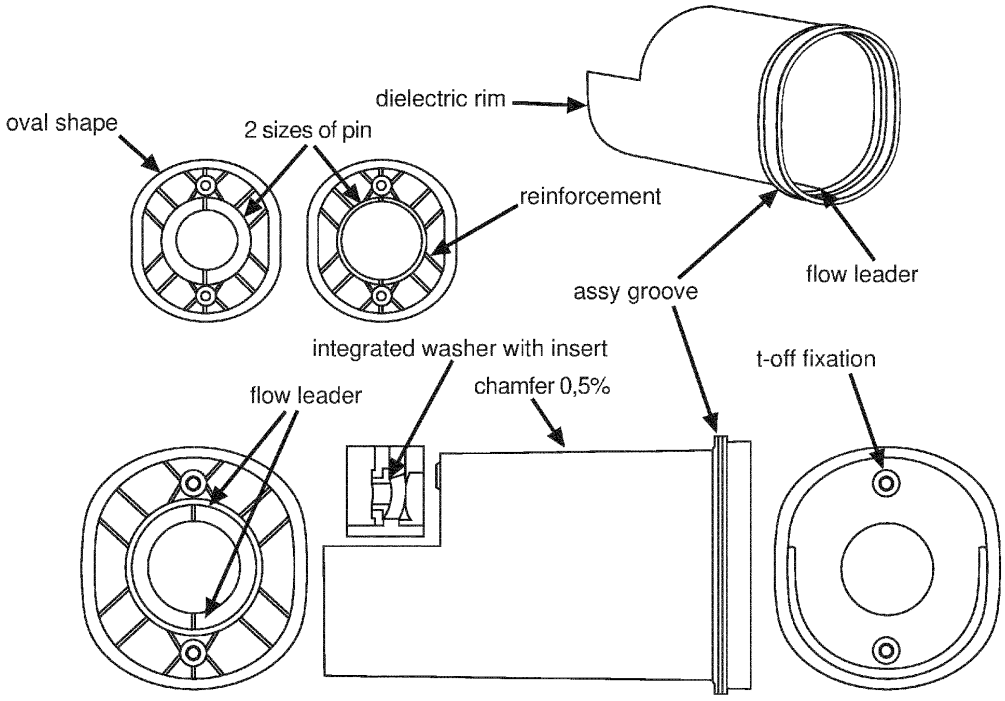

Fig. 2

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Description

FIELD OF THE INVENTION

[0001] The present invention relates to a bushing for a medium voltage switchgear and a bushing system for a metal clad medium voltage switchgear.

BACKGROUND OF THE INVENTION

[0002] In a medium voltage switchgear (or panel) with metal partitions, bushings are important parts of the panel. Bushings, which can also be called spouts (1 per phase) or monoblocks (1 for all 3 phases), can for example be used with circuit breaker compartments.

[0003] Bushings allow current flow between metal-clad switchgear through compartments, and due to high current and/or high voltage parameters, they are large in size and need a significant amount of insulating material that is usually epoxy, which is not possible to recycle.

[0004] Fig. 1 shows an existing epoxy bushing or spout, represented in a partial cut out form, where for example the spout is mounted by 4 screws to a metal plate, such as a contact support, which forms a partition between a circuit breaker compartment and other compartments in the panel. The spout has an insert in the rear wall used for assembling T-offs and pin. The existing spout however is expensive, difficult to assemble, and large.

[0005] There is a need to address these issues.

SUMMARY OF THE INVENTION

[0006] Therefore, it would be advantageous to have an improved bushing for a compartment of a medium voltage switchgear, such as an air or gas insulated switchgear.

[0007] The object of the present invention is solved with the subject matter of the independent claims, wherein further embodiments are incorporated in the dependent claims. It is to be noted that the busing is described with respect to a medium voltage air or gas insulated switchgear, but finds utility in other situations for the connection of high voltage current carrying conductors between compartments.

[0008] In an aspect, there is provided a bushing for a metal clad medium voltage switchgear, the bushing comprising:

- a hollow body; and
- a t-off and pin assembly.

[0009] The hollow body is made from polyamide. The t-off and pin assembly is made from polyamide. A first end of the hollow body is configured to connect to a compartment of a medium voltage switchgear. The t-off and pin assembly is configured to connect to a second end of the hollow body. The t-off and pin assembly is configured to connect to a T-off and pin.

[0010] Thus the new bushing or spout has parts made from recyclable polyamide material, which is also lighter, and less expensive than existing bushings, and by having an independent t-off and pin assembly, different t-off and pin assembly pieces can be used to connect to two different sizes of pin. This means that the main part of the bushing can be used in different situations, requiring a change in the t-off and pin assembly from a part that matches a first size of pin to a part that matches a second size of pin.

[0011] In other words, a modular design is provided that allows the use of different pin diameters and that replaces existing epoxy designs, and that can be used at 12kV and 17kV and 24kV for example, and at currents greater than 1250A. not only is material mass and environmental impact reduced by using a thermoplastic, but larger and different sizes of conductors (pins) can be accommodated allowing for higher current flow and flexibility of utilization, and ease of installation and replacement is enabled.

[0012] In an example, the t-off and pin assembly comprises at least one t-off fixation hole with an integrated washer.

[0013] By having an integrated washer, better dielectric test performance is provided.

[0014] In an example, the t-off and pin assembly comprises a pin opening.

[0015] The pin opening is sized for the size of pin, and in this way connection to different sized pins can be made by only changing the t-off and pin assembly to one with the correctly sized pin opening.

[0016] In an example, a body portion extends from the first end of the hollow body to the second end of the hollow body, and the body portion is substantially oval shaped about an axis extending from the first end of the body to the second end of the body.

[0017] In this manner by having an oval shape, better results of TRT are provided.

[0018] In an example, an outer surface of the body portion is chamfered such that the outer surface is angled to the axis in a direction from the first end of the body to the second end of the body.

[0019] In other words, the outer surface of the body does not have a constant oval cross-section but has an oval cross-section that varies in size along its length. This improves water drainage in condensation conditions.

[0020] In an example, an internal surface of the body portion comprises at least one flow leader.

[0021] The flow leaders facilitate manufacture of the part.

[0022] In an example, a flow leader is in a direction perpendicular to the axis in the direction from the first end of the body to the second end of the body.

[0023] In an example, a surface of the t-off and pin assembly that faces inwards to the hollow body when the t-off and pin assembly is connected to the hollow body comprises at least one flow leader.

[0024] The flow leaders facilitate manufacture of the part.

[0025] In an example, a surface of the t-off and pin assembly that faces inwards to the hollow body when the t-off and pin assembly is connected to the hollow body comprises at least one reinforcement part.

[0026] The reinforcements enable the overall thickness of the part to be reduced, with the overall weight of the part also being reduced, which also leads to reduced cost of the component.

[0027] In an example, the at least one reinforcement part comprises raised ridges in the surface of the t-off and pin assembly.

[0028] In an example, the second end of the hollow body comprises a dielectric rim.

[0029] It is been found that the dielectric rim improves dielectric performance.

[0030] In an example, the first end of the body is configured to connect to the compartment of the switchgear via at least one assembly or assy groove.

[0031] In an example, the t-off and pin assembly has an outer perimeter that is oval shaped.

[0032] From the above, it is clear that a main part of a bushing, in terms of a hollow body, can be provided along with a number of different t-off and pin assembly, each sized for different pins enabling such a system to be utilized in different situations by using the appropriate t-off and pin assembly.

[0033] Thus, in an aspect there is provided a bushing system for a metal clad medium voltage switchgear, the bushing system comprising:

- a hollow body;
- a first t-off and pin assembly; and
- a second t-off and pin assembly.

[0034] The hollow body is made from polyamide. The first t-off and pin assembly is made from polyamide. The first t-off and pin assembly has a pin opening of a first size. The second t-off and pin assembly is made from polyamide. The second t-off and pin assembly has a pin opening of a second size. A first end of the hollow body is configured to connect to a compartment of a medium voltage switchgear. The first t-off and pin assembly is configured to connect to a second end of the hollow body. The second t-off and pin assembly is configured to connect to the second end of the hollow body. The first t-off and pin assembly is configured to connect to a T-off and pin. The second t-off and pin assembly is configured to connect to a T-off and pin. In use either the first t-off and pin assembly is connected to the hollow body or the second t-off and pin assembly is connected to the hollow body.

[0035] The above aspects and examples will become apparent from and be elucidated with reference to the embodiments described hereinafter.

BRIEF DESCRIPTION OF THE DRAWINGS

[0036] Exemplary embodiments will be described in the following with reference to the following drawings:

Fig. 1 shows a schematic representation of an example of an existing bushing or spout for a metal clad medium voltage switchgear; and

Fig. 2 shows an isometric view of a new bushing or spout for a metal clad medium voltage switchgear along with a side view of the new bushing or spout and views of two different t-off and pin assemblies for different sized pins as well as a front view and rear view of one of the two t-off and pin assemblies.

DETAILED DESCRIPTION OF EMBODIMENTS

[0037] Fig. 2 relates to a new bushing or spout for a metal clad medium voltage switchgear.

[0038] The bushing comprises a hollow body, and a t-off and pin assembly. In Fig. 2 the hollow body is shown in isometric view at the top right and in side view in the middle at the bottom. At the top right, two different t-off and pin assemblies are shown, sized for different pins. Either side of the side view of the hollow body one of these two t-off and pin assemblies is shown, viewed from the inside and outside wen attached or connected to the hollow body. The hollow body is made from polyamide. The t-off and pin assembly is made from polyamide. A first end of the hollow body is configured to connect to a compartment of a medium voltage switchgear. The t-off and pin assembly is configured to connect to a second end of the hollow body. The t-off and pin assembly is configured to connect to a T-off and pin.

[0039] Thus the new bushing or spout has parts made from recyclable polyamide material, which is also lighter, and less expensive than existing bushings, and by having an independent t-off and pin assembly, different t-off and pin assembly pieces can be used to connect to two different sizes of pin. This means that the main part of the bushing can be used in different situations, requiring a change in the t-off and pin assembly from a part that matches a first size of pin to a part that matches a second size of pin.

[0040] According to an example, the t-off and pin assembly comprises at least one t-off fixation hole with an integrated washer.

[0041] By having an integrated washer, better dielectric test performance is provided.

[0042] According to an example, the t-off and pin assembly comprises a pin opening.

[0043] The pin opening is sized for the size of pin, and in this way connection to different sized pins can be made by only changing the t-off and pin assembly to one with the correctly sized pin opening.

[0044] According to an example, a body portion extends from the first end of the hollow body to the second

end of the hollow body, and the body portion is substantially oval shaped about an axis extending from the first end of the body to the second end of the body.

[0045] In this manner by having an oval shape, better results of TRT are provided.

[0046] According to an example, an outer surface of the body portion is chamfered such that the outer surface is angled to the axis in a direction from the first end of the body to the second end of the body.

[0047] In other words, the outer surface of the body does not have a constant oval cross-section but has an oval cross-section that varies in size along its length. This improves water drainage in condensation conditions.

[0048] In an example, the chamfer is 0.5%.

[0049] In an example, the chamfer is 0.3%.

[0050] In an example, the chamfer is 1%.

[0051] In an example, the chamfer is 2%.

[0052] In an example, the chamfer is 5%.

[0053] In an example, the chamfer is 10%.

[0054] According to an example, an internal surface of the body portion comprises at least one flow leader.

[0055] The flow leaders facilitate manufacture of the part.

[0056] According to an example, a flow leader is in a direction perpendicular to the axis in the direction from the first end of the body to the second end of the body.

[0057] According to an example, a surface of the t-off and pin assembly that faces inwards to the hollow body when the t-off and pin assembly is connected to the hollow body comprises at least one flow leader.

[0058] The flow leaders facilitate manufacture of the part.

[0059] According to an example, a surface of the t-off and pin assembly that faces inwards to the hollow body when the t-off and pin assembly is connected to the hollow body comprises at least one reinforcement part.

[0060] The reinforcements enable the overall thickness of the part to be reduced, with the overall weight of the part also being reduced, which also leads to reduced cost of the component.

[0061] According to an example, the at least one reinforcement part comprises raised ridges in the surface of the t-off and pin assembly.

[0062] According to an example, the second end of the hollow body comprises a dielectric rim.

[0063] It is been found that the dielectric rim improves dielectric performance.

[0064] According to an example, the first end of the body is configured to connect to the compartment of the switchgear via at least one assembly or assy groove.

[0065] According to an example, the t-off and pin assembly has an outer perimeter that is oval shaped.

[0066] A single hollow body can be provided with two or more t-off and pin assemblies, each designed for a different size of pin - as shown in Fig. 2.

[0067] Such a system comprises a hollow body, a first t-off and pin assembly, and a second t-off and pin assembly. The hollow body is made from polyamide. The first t-off and pin assembly is made from polyamide. The first t-off and pin assembly has a pin opening of a first size. The second t-off and pin assembly is made from polyamide. The second t-off and pin assembly has a pin opening of a second size. A first end of the hollow body is configured to connect to a compartment of a medium voltage switchgear. The first t-off and pin assembly is configured to connect to a second end of the hollow body. The second t-off and pin assembly is configured to connect to the second end of the hollow body. The first t-off and pin assembly is configured to connect to a T-off and pin. The second t-off and pin assembly is configured to connect to a T-off and pin. In use either the first t-off and pin assembly is connected to the hollow body or the second t-off and pin assembly is connected to the hollow body.

[0068] In an example, the first t-off and pin assembly comprises at least one t-off fixation hole with an integrated washer.

[0069] In an example, the second t-off and pin assembly comprises at least one t-off fixation hole with an integrated washer.

[0070] In an example, a body portion extends from the first end of the hollow body to the second end of the hollow body, and the body portion is substantially oval shaped about an axis extending from the first end of the body to the second end of the body.

[0071] In an example, an outer surface of the body portion is chamfered such that the outer surface is angled to the axis in a direction from the first end of the body to the second end of the body.

[0072] In an example, the chamfer is 0.5%.

[0073] In an example, the chamfer is 0.3%.

[0074] In an example, the chamfer is 1%.

[0075] In an example, the chamfer is 2%.

[0076] In an example, the chamfer is 5%.

[0077] In an example, the chamfer is 10%.

[0078] In an example, an internal surface of the body portion comprises at least one flow leader.

[0079] In an example, a flow leader is in a direction perpendicular to the axis in the direction from the first end of the body to the second end of the body.

[0080] In an example, a surface of the first t-off and pin assembly that faces inwards to the hollow body when the first t-off and pin assembly is connected to the hollow body comprises at least one flow leader.

[0081] In an example, a surface of the second t-off and pin assembly that faces inwards to the hollow body when the second t-off and pin assembly is connected to the hollow body comprises at least one flow leader.

[0082] In an example, a surface of the first t-off and pin assembly that faces inwards to the hollow body when the first t-off and pin assembly is connected to the hollow body comprises at least one reinforcement part.

[0083] In an example, a surface of the second t-off and pin assembly that faces inwards to the hollow body when the second t-off and pin assembly is connected to the hollow body comprises at least one reinforcement part.

[0084] In an example, the at least one reinforcement part of the first t-off and pin assembly comprises raised ridges in the surface of the first t-off and pin assembly.

[0085] In an example, the at least one reinforcement part of the second t-off and pin assembly comprises raised ridges in the surface of the second t-off and pin assembly.

[0086] In an example, the second end of the hollow body comprises a dielectric rim.

[0087] In an example, the first end of the body is configured to connect to the compartment of the switchgear via at least one assembly or assy groove.

[0088] In an example, the first t-off and pin assembly has an outer perimeter that is oval shaped.

[0089] In an example, the second t-off and pin assembly has an outer perimeter that is oval shaped.

[0090] As shown in Fig. 2, one end of the bushing as a dielectric rim that provides better results in dielectric tests. An assy or assembly groove or grooves provided to enable connection to a compartment of the switchgear without requiring screws or bolts, with an internal flow leader in an inner surface of the body of the bushing, which facilitates manufacture. The overall shape of the hollow body of the bushing and independent t-off and pin assemblies is oval, which results in better TRT. The t-off and pin assembly is independent and has a central opening sized to the size of a pin, enabling different t-off and pin assemblies to be used as required. The inner surface of the t-off and pin assembly also has a flow leader to aid manufacture, and modeling and simulation was used to design raised reinforcement ridges. The modelling and simulation used to deign the reinforcement profiles or ridges took into account the properties polyamide. The body of the bushing is slightly tapered or chamfered, providing for improved drainage in condensation conditions. The t-off and pin assembly also has t-off fixation holes with an integrated washer with insert, that also yielded better results in dielectric tests.

[0091] Thus, the new bushing or spout is made from recyclable polyamide material, with computer simulations used to design reinforcements providing for maintenance of structural integrity for less overall material. The new design has independent t-off and pin assemblies that come with different pin openings for flexibility of utilization, and with flow leaders for improved manufacturability and reinforcement ridges for weight reduction. The new bushing features a fastener-less assembly (partial), with a built-in dielectric rim, with a chamfer of 0.5% for improved drain in condensation conditions. The design can therefore be silicone-free, and has lower weight and lower cost with respect to the existing bushings.

[0092] Bushings are important components of metal-clad switchgear. Existing bushings or spout are screw-mounted, and made of epoxy. The new bushing provides for partially fastener-free assembly (easier, faster), has advantage in improved drainage (increased reliability), weight (green) and cost, uses and recyclable thermoplastics (green), and provides for increased current operation, improved installation and replacement and flexibility of utility with respect to pin size..

[0093] Thus, the new bushing provides significant improvements over existing epoxy or epoxide bushings or spouts.

Claims

1. A bushing for a metal clad medium voltage switchgear, the bushing comprising:

   - a hollow body; and
   - a t-off and pin assembly;

   wherein the hollow body is made from polyamide;
   wherein the t-off and pin assembly is made from polyamide;
   wherein a first end of the hollow body is configured to connect to a compartment of a medium voltage switchgear;
   wherein the t-off and pin assembly is configured to connect to a second end of the hollow body; and
   wherein the t-off and pin assembly is configured to connect to a T-off and pin.

2. Bushing according to claim 1, where the t-off and pin assembly comprises at least one t-off fixation hole with an integrated washer.

3. Bushing according to any of claims 1-2, where the t-off and pin assembly comprises a pin opening.

4. Bushing according to any of claims 1-3, wherein a body portion extends from the first end of the hollow body to the second end of the hollow body, and wherein the body portion is substantially oval shaped about an axis extending from the first end of the body to the second end of the body.

5. Bushing according to claim 4, wherein an outer surface of the body portion is chamfered such that the outer surface is angled to the axis in a direction from the first end of the body to the second end of the body.

6. Bushing according to any of claims 4-5, wherein an internal surface of the body portion comprises at least one flow leader.

7. Bushing according to claim 6, wherein a flow leader is in a direction perpendicular to the axis in the direction from the first end of the body to the second end of the body.

8. Bushing according to any of claims 1-7, wherein a

surface of the t-off and pin assembly that faces inwards to the hollow body when the t-off and pin assembly is connected to the hollow body comprises at least one flow leader.

9. Bushing according to any of claims 1-8, wherein a surface of the t-off and pin assembly that faces inwards to the hollow body when the t-off and pin assembly is connected to the hollow body comprises at least one reinforcement part.

10. Bushing according to claim 9, wherein the at least one reinforcement part comprises raised ridges in the surface of the t-off and pin assembly.

11. Bushing according to any of claims 1-9, wherein the second end of the hollow body comprises a dielectric rim.

12. Bushing according to any of claims 1-10, wherein the first end of the body is configured to connect to the compartment of the switchgear via at least one assembly or assy groove.

13. Bushing according to any of claims 1-12, where the t-off and pin assembly has an outer perimeter that is oval shaped.

14. A bushing system for a metal clad medium voltage switchgear, the bushing system comprising:

- a hollow body;
- a first t-off and pin assembly; and
- a second t-off and pin assembly;

wherein the hollow body is made from polyamide;
wherein the first t-off and pin assembly is made from polyamide;
wherein the first t-off and pin assembly has a pin opening of a first size;
wherein the second t-off and pin assembly is made from polyamide;
wherein the second t-off and pin assembly has a pin opening of a second size;
wherein a first end of the hollow body is configured to connect to a compartment of a medium voltage switchgear;
wherein the first t-off and pin assembly is configured to connect to a second end of the hollow body;
wherein the second t-off and pin assembly is configured to connect to the second end of the hollow body;
wherein the first t-off and pin assembly is configured to connect to a T-off and pin;
wherein the second t-off and pin assembly is configured to connect to a T-off and pin;
and
wherein in use either the first t-off and pin assembly is connected to the hollow body or the second t-off and pin assembly is connected to the hollow body.

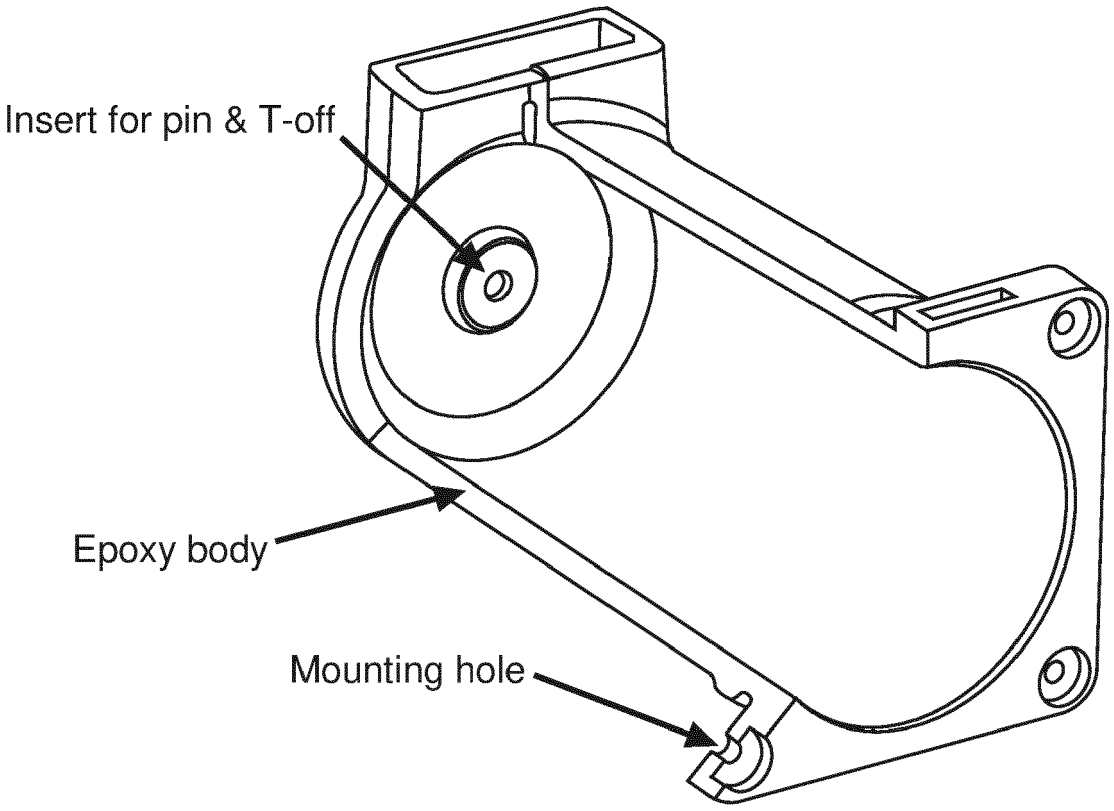

Fig. 1

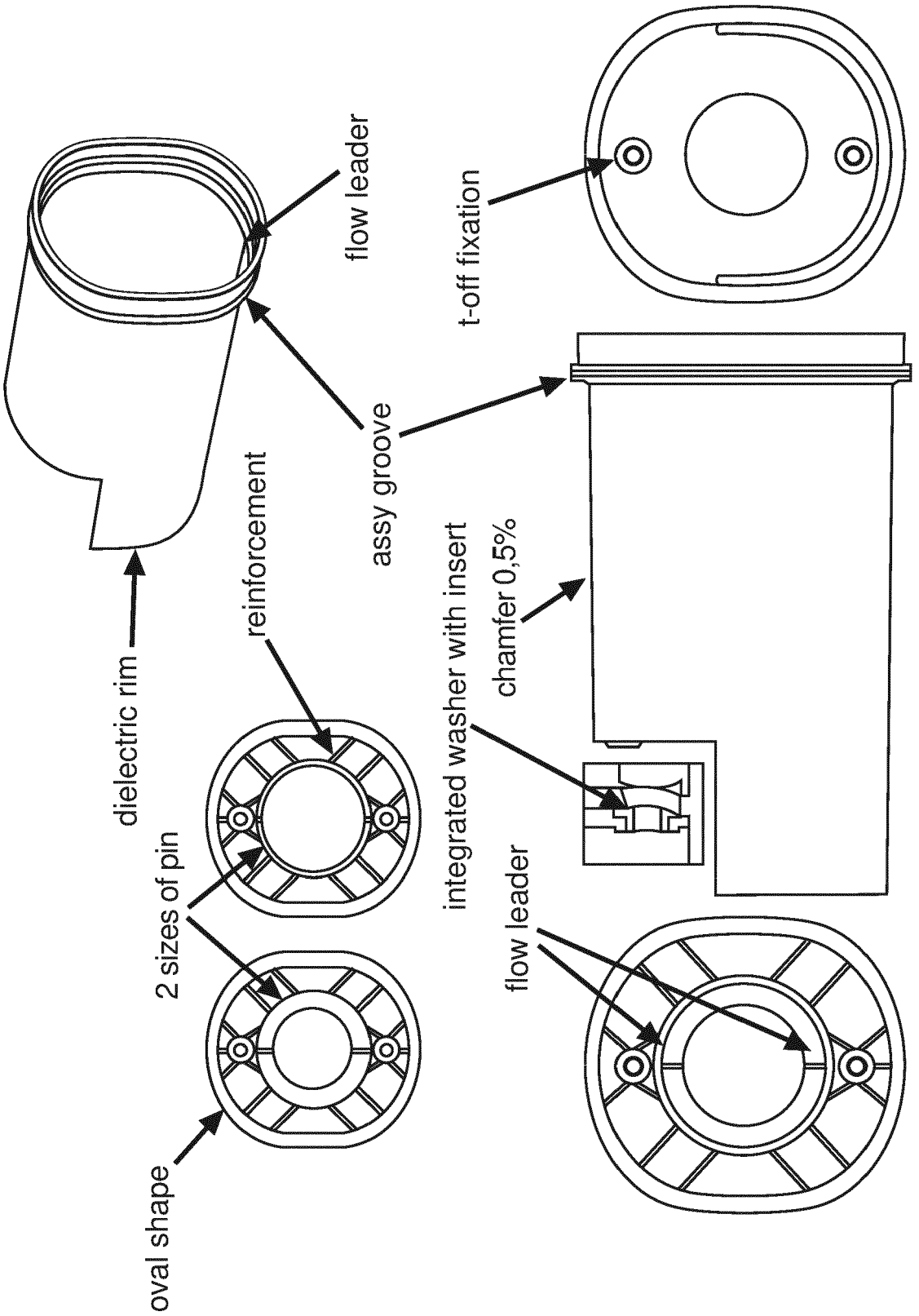
flow leader
t-off fixation
assy groove
reinforcement
dielectric rim
2 sizes of pin
oval shape
integrated washer with insert
chamfer 0,5%
flow leader

Fig. 2

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EUROPEAN SEARCH REPORT

Application Number
EP 22 20 5028

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 3 863 135 A1 (ABB SCHWEIZ AG [CH]) 11 August 2021 (2021-08-11) * claims 1-11; figures 2-3 *	1-14	INV. H02B11/04
A	JP S55 130518 U (UNKNOWN) 16 September 1980 (1980-09-16) * figures 5-9 *	1,14	

TECHNICAL FIELDS SEARCHED (IPC)

H02B
H01R
H01B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	21 March 2023	Starck, Thierry

CATEGORY OF CITED DOCUMENTS

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21-03-2023

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